# PATENT SPECIFICATION (11) 1 466 564

1 466 564

(21) Application No. 31937/76 (22) Filed 12 June 1973 (19)

(62) Divided out of No. 1 466 563

(23) Complete Specification filed 30 May 1974

(44) Complete Specification published 9 March 1977

(51) INT. CL.² F16J 13/00

(52) Index at acceptance
F2H 18

(72) Inventor DOUGLAS WILLIAM BIRMINGHAM

## (54) APERTURE PLUG

(71) We, UNITED-CARR LIMITED, a British company of 57 Chiswell Street, London, EC1Y 4FY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following particularly useful if the plug is used to seal an aperture in a curved panel.

Preferably, the locating portion comprises a plurality of legs projecting from the plate portion and adapted to locate through the aperture and temporarily hold the plate in position while the plug is being bonded to

PATENTS ACT 1949

SPECIFICATION NO 1466564

The following amendments were allowed under Section 29 on 12 May 1983

Page 1, line 17, Page 2, line 109, *before* panel *insert* vehicle body
Page 1, line 22, Page 2, line 114, *after* attaching *insert* to the plug
Page 1, line 23, Page 2, line 115, *delete* to the
Page 1, *delete* lines 24 and 25
Page 2, *delete* lines 116 and 117
Page 1, *after* line 25, Page 2, *after* 117 *insert* the sealing member having a sealing portion and a retaining portion and being fitted over the flange portion so as to be retained thereon with the sealing portion against the side of the flange portion adapted to overlie the panel;
Page 1, *delete* lines 64 to 67 and 71 to 73
Page 1, line 68 *for* 5 *read* 3
Page 1, line 69, *delete* 3 attached in *insert* 1 having a sealing ring attached,
Page 1, line 99 *for* 4 *read* 3
Page 2, *delete* lines 1 to 31 and 80 to 90
Page 2, line 32, *delete* conditions are present then we *insert* We
Page 2, line 40, *for* 6 *read* 3
Page 2, line 44, *after* 27, *insert* and a retaining portion consisting of
Page 2, line 48, *delete* on *insert* over the flange portion of
Page 2, lines 55 and 56, *delete* panel 31, in the same way as the plug 10 *insert* vehicle body panel 31,
Page 2, *delete* lines 68 to 70 *insert* The plug is located in the
Page 2, line 91, *delete* also
Page 3, *delete* lines 28 to 34
Page 3, *for* claims 8 to 10 *read* 6 to 8
Cancel Figs, 3, 4, 5 and 6 on sheet 2 of drawings *insert*

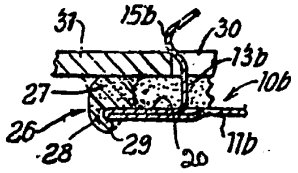


FIG. 3

THE PATENT OFFICE
*18 July 1983*

Bas 252432/7

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## (54) APERTURE PLUG


(71) We, UNITED-CARR LIMITED, a British company of 57 Chiswell Street, London, EC1Y 4FY, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—


The present invention relates to a method of closing and sealing an aperture in a panel. The present invention is also described in our co-pending Application No. 28011/73 (Serial No. 1,466,563) from which the present application has been divided.

According to the present invention we provide a method of sealing an aperture in a panel comprising the steps of:

taking a plug having a plate portion adapted to close the aperture and a flange portion adapted to overlie the surface of the panel in the region adjacent the aperture;

attaching a sealing member of resilient or deformable heat bondable material to the side of the flange portion adapted to overlie the panel;

locating the plug over the aperture so that the plate portion closes the aperture and the sealing member is trapped between the flange portion and the panel;

heating the plug to a temperature sufficient to soften the sealing member; and

cooling the plug to bond the sealing member to the panel and to the plug thereby sealing the aperture.

We have found that it is advantageous to form the sealing member from a plastics material which will flow to a limited extent when subjected to a high temperature. This type of sealing member is particularly useful if the plug is used to seal an aperture in a vehicle body before the vehicle passes through a paint oven. Initially, the plug will make a good seal of the aperture but when the vehicle is subjected to a temperature of 140°—170°C in a paint oven the material of the sealing member will flow to fill any irregularities in the plate portion of the plug or in the part of the vehicle body against which the plug is located and thereby ensure a complete seal. This is particularly useful if the plug is used to seal an aperture in a curved panel.

Preferably, the locating portion comprises a plurality of legs projecting from the plate portion and adapted to locate through the aperture and temporarily hold the plate in position while the plug is being bonded to the panel.

A preferred form of the invention will now be described with reference to the accompanying drawings, in which:—

Figures 1 and 2 are respectively a plan and elevation of a plug;

Figure 3 is a plan view of the plug of Figure 1 with a sealing ring bonded to it;

Figure 4 is a section on the line V—V of Figure 3;

Figure 5 is an elevation, in section of the plug of Figure 3 attached in and sealing an aperture in a panel and

Figure 6 is a view similar to Figure 5 showing a modification of the sealing ring of Figures 3 to 5.

In Figures 1 and 2 a metal plug is indicated generally at 10. The plug 10, which is formed from thin sheet steel and rendered resilient during manufacture, comprises a circular plate 11 and a locating portion in the form of three retaining legs 12, 13 and 14. The legs 12, 13 and 14 are equiangularly spaced around the periphery of the plate 11 and each leg includes an outwardly inclined retaining portion 15 and an inwardly inclined lead-in portion 16.

The legs 12, 13 and 14 are similar and each leg is formed from a tongue 17 (shown in broken lines in Figure 1) which is formed integrally with the plate 11 and folded back onto the plate 11 to form a fold 18 from which the respective leg projects at right angles and outwardly from the plate 11. A depression 19 is formed in the plate 11 to receive the fold 18 of each tongue so that the outer surface of the fold is flush with the adjacent surface of the plate. As can be seen from Figure 1 the legs 12, 13 and 14 are spaced inwardly from the periphery of the plate 11 so as to leave a continuous annular surface 20 (see Figure 4) around the periphery of the plate.

A layer of a polyvinylchloride based compound is then applied to the annular surface 20 of the plug 10 and the compound is cured so as to bond the layer to the plate 11 and provide a sealing member in the form of a ring seal 23 which is bonded to the plate 11 outside the legs 12, 13 and 14. A suitable material for the ring seal 23 is that sold by W. G. Grace & Co. as PLASTICOL Compound No. 1,268.

The plug 10 is then applied to an aperture 24 in a panel 25, as shown in Figure 5, with the legs 12, 13 and 14 projecting through the aperture and the rim of the aperture clamped between the inclined retaining portions 15 of the legs and the ring seal 23.

We have found that a suitable polyvinylchloride based compound such as PLASTICOL 1268 can be cured at about 160°C for 1 to 2 minutes so as to bond effectively on the plate 11. When cooled it becomes non-tacky and has sufficient resilience to form a good seal against a panel aperture taking up surface irregularities. It will subsequently withstand temperatures of up to 250°C and when re-heated it will soften slightly but will not melt or become tacky.

The plug 10 incorporating the sealing ring 23 has been found satisfactory in most conditions where the surface irregularities in the panel are not too great. If either of these conditions are present then we have found it advantageous to form the sealing ring from a material such as a low density polythene which will flow when heated so as to fill all the surface irregularities of both the panel and the plate portion of the plug.

An example of a plug 10*b* having a sealing ring 26, which is formed from a low density polythene is shown in Figure 6.

The sealing ring 26 is preferably injection moulded, although it can be blanked from sheet material, and comprises an annular sealing portion 27, a web 28 which is of slightly smaller internal diameter than the diameter of the plate 11*b*, and a retaining rib 29. The ring 26 is stretched and fitted on the plate 11*b* where it is retained by the rib 29 with the sealing portion 27 located on the annular surface 20*b* of the plug.

The plug 10*b* can be transported and handled with the ring 26 located in position by the resilience of the material and by the retaining rib 29. In use, the plug 10*b* is applied to an aperture 30 in a panel 31, in the same way as the plug 10 so that the sealing portion 27 surrounds the panel aperture 30 and is trapped between the panel 31 and the plate 11*b*. The panel and the plug 10*b* are then subjected to a temperature sufficient to soften the polythene causing it to flow. As the polythene material softens and flows it fills all of the surface irregularities of the panel 31 and of the plate 11*b* and also bonds to both the panel and the plate as shown in broken lines in Figure 6 so as to form a water-tight seal.

The plug 10*b* is particularly useful for sealing apertures in vehicle body panels. In this application, the plug is located in the body panel with the ring 26 loosely fitted on the plate 11*b* and the body panel and plug are then subjected to the temperatures of 140°C—170°C or more of a vehicle paint oven. The temperature of the paint oven causes the polythene material of the ring 26 to flow filling irregularities in the panel surface and then bond to the panel and plate as it cools.

It will be appreciated that the sealing ring 26 can be attached to the plate portion of the plug in any convenient manner prior to heating and the shape of the sealing ring can also be modified. For instance, the rib 29 could be eliminated and the resulting sealing ring temporarily adhered to the plate portion prior to heating. Alternatively, the sealing ring can be attached to the plate portion of the plug with the aid of prongs, sheared from the plate portion.

It will also be appreciated that the material from which the sealing ring is formed can be varied and will be suited to the particular conditions under which the plug is used.

The number of legs provided on any of the plugs of the present invention can be varied, for instance, two or more legs can be provided to suit the particular application in which the plug is to be used. In addition, the shape of the plate portion of the plug can be varied, for instance, it can be externally oval, square or elongate and can also be curved to fit a curved surface.

WHAT WE CLAIM IS:—

1. A method of sealing an aperture in a panel comprising the steps of:

taking a plug having a plate portion adapted to close the aperture and a flange portion adapted to overlie the surface of the panel in the region adjacent the aperture;

attaching a sealing member of resilient or deformable heat bondable material to the side of the flange portion adapted to overlie the panel;

locating the plug over the aperture so that the plate portion closes the aperture and the sealing member is trapped between the flange portion and the panel;

heating the plug to a temperature sufficient to soften the sealing member; and

cooling the plug to bond the sealing member to the panel and to the plug thereby sealing the aperture.

2. A method as claimed in claim 1, wherein the plug includes a plurality of legs projecting from the plate portion and adapted to locate through the aperture and

temporarily hold the plate in position while the plug is being bonded to the panel.

3. A method as claimed in claim 2, wherein the legs are resilient and outwardly elbowed and are snap-engageable through the aperture.

4. A method as claimed in claim 1, wherein the plug comprises a plate portion and a plurality of resilient legs which depend from the plate portion and which can be snap-engaged through the aperture in the panel, the legs being formed by radial extensions of the flange portion which have been folded back so as to lie flat against the flange portion and then had their free ends portions bent away from the plate portion so that the legs project from the plate portion from a position radially inwardly of the periphery of the flange portion leaving the periphery of the flange portion unbroken.

5. A method af sealing an aperture in a panel as claimed in claim 4, wherein the sealing member is formed from a resilient or deformable material located on the flange portion outside the legs so as to overlie at least a part of the folded back portions of the legs.

6. A method as claimed in any preceding claim including the step of adhering the sealing member to the flange portion prior to insertion of the plug in the aperture.

7. A method as claimed in claim 6, wherein the sealing member is cured and bonded to the flange portion.

8. A method as claimed in any preceding claim wherein the sealing member is formed from a flowable plastics material.

9. A method as claimed in any preceding claim, wherein the sealing is formed from a material which will soften and flow when heated to a temperature in excess of 140°C.

10. A method of sealing an aperture to a panel substantially as described herein.

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1466564 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG.1

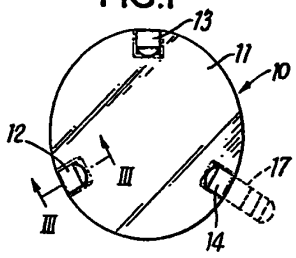
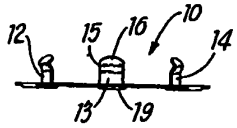



FIG.2



1466564 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

FIG.3

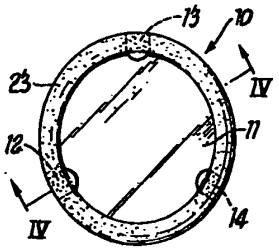



FIG.4

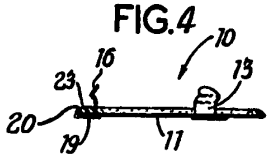
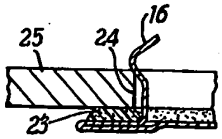



FIG.5



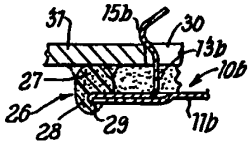




FIG.6